STATUS OF THE CLAIMS

Claims 1-16 were originally filed in this patent application. In the pending office action, claims 2-4, 8 and 12-16 were rejected under 35 U.S.C. §112, second paragraph. Claims 1-16 were rejected under 35 U.S.C. §101. Claims 1-16 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Application Publication 2004/0059743 to Burger in view of Applicant's Admitted Prior Art (AAPA). No claim was allowed. In this amendment, claims 10, 11, 15 and 16 have been cancelled, and claims 1-2, 4-9 and 12-14 have been amended. Claims 1-9 and 12-14 are currently pending.

REMARKS

Objections to the Specification

The examiner objected to the specification. The paragraph on p. 9 lines 4-24 has been deleted herein and replaced with a paragraph that corrects a minor typographical error.

The examiner's remarks regarding the trademarks using in this patent application are noted. Applicants have chosen not to capitalize eServer and iSeries because typically they are not capitalized in their normal usage as trademarks.

Rejection of claims 2-4, 8 and 12-16 under 35 U.S.C. §112, second paragraph

The examiner rejected claims 2-4, 8 and 12-16 under 35 U.S.C. §112, second paragraph. These claims have been amended to address the issues the examiner raised in these rejections under 35 U.S.C. §112, second paragraph. As a result, the rejection of these claims under 35 U.S.C. §112, second paragraph, has been traversed.

Rejection of claims 1-16 under 35 U.S.C. §101

Claims 1-16 were rejected under 35 U.S.C. §101 as being allegedly directed to non-statutory subject matter. Claim 1 has been amended herein to recite a query optimizer residing in the memory that uses the estimated cardinality from the cardinality estimator to optimize the query. Claim 4 has been amended herein to recite a query optimizer residing in the memory that uses the estimated cardinality of the intermediate dataset to optimize the query. Claim 5 has been amended herein to recite a method for optimizing a query to a database table by estimating cardinality of an intermediate dataset that results from processing the query, the method comprising the steps of: (A) evaluating

the query; (B) estimating cardinality of the intermediate dataset using a formula that accounts for data skew in the database table; and (C) using the cardinality estimate in step (B) to optimize the query. Claim 8 has been amended herein to recite a method for optimizing a query to a database table by estimating cardinality of an intermediate dataset that results from processing the query, the method comprising the steps of: (A) evaluating the query; (B) estimating the cardinality Ca' of the intermediate dataset using a specific recited formula; and (C) using the cardinality estimate in step (B) to optimize the query. Claims 9 and 14 have both been amended herein to recite a query optimizer that uses the estimated cardinality from the cardinality estimator to optimize the query. All of the independent claims has thus been amended to recite a useful, concrete and tangible result of optimizing a query to a database using the cardinality estimate. As a result, all of the pending claims recite statutory subject matter under 35 U.S.C. §101.

Claims 9 and 14 have also been amended herein to recite recordable media, and claims 10-11 and 15-16 have been cancelled. As a result, claims 9 and 14 are limited by their express terms to statutory subject matter under 35 U.S.C. §101.

Rejection of claims 1-16 under 35 U.S.C. §103(a)

The examiner rejected claims 1-16 under 35 U.S.C. §103(a) as being unpatentable over Burger in view of AAPA. Each of these claims is addressed below.

Claim 1

Claim 1 was rejected based on the combination of Burger and AAPA. In the rejection, the examiner states that Burger teaches an access module processor that collects statistical information on a sample size (intermediate dataset), such as data value frequencies, to determine data skew for feeding into a query optimizer, citing paragraphs 0019, 0030 and 0031 of Burger. The examiner admits that Burger does not expressly

disclose the cardinality estimator with all the express limitations in claim 1. The examiner correctly states that AAPA discloses a prior art method and probabilistic formula for estimating cardinality of an intermediate dataset. The examiner then states that it would have been obvious to one of ordinary skill in the art to modify the apparatus of Burger by adding a cardinality estimator as taught in the AAPA, modified by the teachings of Burger in a manner that accounts for data skew in the database table. Applicants respectfully assert that neither Burger nor AAPA teach, suggest or support the combination proposed by the examiner, that a reasonable combination of Burger and AAPA does not result in the unique combination of features recited in claim 1, and that the only motivation for the examiner's combination of Burger and AAPA is based on impermissible hindsight reconstruction. Each of these points are addressed in detail below.

Neither Burger nor AAPA Teach, Suggest or Support the Examiner's Combination

To determine whether the examiner's combination of Burger and AAPA is reasonable, we must first examine the teachings of these two references. The portions of Burger cited in the rejection of claim 1 are paragraphs 0019, 0030 and 0031. Paragraph 0019 discloses optimizing queries using statistics to reduce the search space. See paragraph 0019 of Burger, last two lines. Paragraph 0030 and 0031 discuss a (Value,Count) data structure that the AMP 16 may use to determine if a skewed value has been detected, where a Value is skewed if Count is greater than some predefined number. It is important, however, to determine how this skewed data information is used in Burger. Burger deals with collecting statistics based on a sample (less than all rows of the table). See Burger Abstract. The sample size is adjusted as the table is scanned in response to detecting a predetermined characteristic of the table, such as skewed data values. See Burger Abstract. Burger thus detects skewed data values, and in response, increases the sample size to increase the accuracy of the sample. This is shown in FIG. 2

of Burger, where the Skip Factor N is adjusted based on the number of instances of detecting skew in step 110. Paragraph 0031 of Burger at lines 1-15 states:

> Next, the AMP 16 determines (at 108) if a skewed value has been detected. This occurs when a given attribute value exceeds a predetermined frequency of occurrence. In other words, Value is skewed if Count is greater than some predefined number. If this is detected, then the skip factor N is adjusted (at 110). In one embodiment, the skip factor N is reduced to increase the sample size. The value of N is adjusted based on the number of instances of detecting skew. The more instances of skewed values detected, the lower the value of N. In other words, if there is a lot of skew detected when scanning the table, the sample size continues to be increased by successively decreasing the value of N. In one embodiment, the minimum value of N is 1, so that the sample size is typically less than or equal to 50% of a given table.

We see from this express language of Burger that when skew is detected, the sample size is increased (by lowering the value of the skip factor N). The skip factor essentially dictates how many records are in the sample. Thus, with a skip factor of 3, a data record is selected for the sample, the next three records are skipped, the next data record is selected for the sample, the next three records are skipped, etc. As a result, a skip factor of 3 produces a sample of 25% of the table. A skip factor of 2 produces a sample of 33% of the table. And a skip factor of 1 produces a sample of 50% of the table, as stated expressly in Burger.

It is true that Berger teaches detecting skew when Count is greater than some predefined number. However, detecting skew in Burger results in increasing the sample size by decreasing the skip factor N. Increasing the sample size reduces the effects of skew by including more of the table in the sample. However, the size of a sample in Burger has no bearing on the computation of cardinality in AAPA.

For the examiner to combine Burger and AAPA as suggested in the rejection, there must be some motivation in these references or general knowledge in the art that

supports this specific combination. Burger teaches increasing the sample size for sampled statistics collection when data skew is detected. AAPA teaches a prior art method and probabilistic formula for estimating cardinality of an intermediate dataset. Nowhere is there any motivation in Burger, AAPA or knowledge in the art to change the cardinality estimate in AAPA when data skew is detected as discussed in Burger. The examiner's stated motivation to combine Burger and AAPA requires modifying AAPA by the teachings of Burger in a manner that accounts for data skew in the database table. However, the teachings of Burger related to adjusting the sample size for sampled statistics collection, and have nothing to do with estimating cardinality. The Federal Circuit has held that the mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 1266, 23 U.S.P.Q.2d 1780, 1783-84 (Fed. Cir. 1992)(citing In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984)). Because none of Burger, AAPA, nor general knowledge in the art suggests the desirability of the modification proposed in the examiner's rejection of claim 1, the examiner's combination of Burger and AAPA is improper under 35 U.S.C. §103(a).

A Reasonable Combination of Burger and AAPA does not Result in the Unique Combination of Features recited in claim 1

Applicants respectfully assert that a reasonable combination of Burger and AAPA does not result in the unique combination of features recited in claim 1. While both Burger and AAPA generally discuss query optimization, the specifics of both are vastly different. Burger teaches a sampled statistics collection, and dynamically adjusting the sample size when data skew is present. AAPA discusses estimating cardinality so a query optimizer may determine appropriate optimizations to the query. The concepts in Burger and AAPA do not overlap, and could be used in combination with each other. Thus, a reasonable combination of Burger and AAPA would provide sampled statistics in Burger

whose sample size may be dynamically adjusted when data skew is detected in Burger, along with the cardinality estimator in AAPA that estimates cardinality based on the prior art methods and formulas disclosed in AAPA. A reasonable combination of Burger and AAPA does not teach, suggest or support changing a cardinality estimate as taught in AAPA based on detecting when data skew is present in Burger. Increasing the sample size in Burger has no relation to the cardinality estimate in AAPA. As a result, a reasonable combination of Burger and AAPA does not result in the unique combination of features recited in claim 1.

The Only Motivation for the Examiner's Combination of Burger and AAPA is Based on Impermissible Hindsight Reconstruction

Applicants respectfully assert the examiner's combination of Burger and AAPA is based on impermissible hindsight reconstruction. The Federal Circuit has held:

> It is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the prior art so that the claimed invention is rendered obvious. In re Fritch, 972 F.2d 1260, 1266, 23 U.S.P.Q.2d 1780, 1784 (Fed. Cir. 1992)(citing In re Gorman, 933 F.2d 982, 987, 18 U.S.P.Q.2d 1885, 1888 (Fed. Cir. 1991)).

It is evident from the examiner's rejection of claim 1 that the examiner has used the claim as a template to piece together the teachings of Burger and AAPA so that the claimed invention is rendered obvious. The Federal Circuit also held:

> When prior art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gleaned from the invention itself. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 U.S.P.Q.2d 1434, 1438 (Fed. Cir. 1988)(citing Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1143, 227 U.S.P.Q. 543, 551 (Fed. Cir. 1985)).

In this case, the only reason for the combination of Burger and AAPA is from applicant's claims. Nowhere does Burger nor AAPA teach or suggest the desirability of the combination suggested by the examiner in rejecting claim 1. The only motivation resides in applicants' claims, which amounts to impermissible hindsight reconstruction. As a result, the examiner's rejection is based on impermissible hindsight reconstruction, and is therefore defective.

For the many reasons given above, the examiner's combination of Burger and AAPA is improper, and a reasonable combination of Burger and AAPA does not teach the express limitations in claim 1. For these reasons, claim 1 is allowable over the combination of Burger and AAPA, and applicants respectfully request reconsideration of the examiner's rejection of claim 1 under 35 U.S.C. §103(a).

Claim 2

In the rejection of claim 2, the examiner states:

> At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Burger by adding a cardinality estimator that estimates the cardinality of the intermediate dataset, taught by AAPA, by performing the steps disclosed in Burger for determining frequency counts and additionally if the frequency does not exceed the predetermined threshold, using a formula, taught by AAPA, to estimate the cardinality of the intermediate dataset, the formula modified by Burger's teachings for accounting for data skew in the database table by subtracting the frequency of all values above the predetermined threshold in the frequent value table that satisfy the query from the total number of columns in the database table.

Note that "total number of columns" in claim 2 was an inadvertent error, and has been corrected herein to recite "total number of rows." Applicants respectfully assert that there is no teaching in either AAPA nor Burger for subtracting the frequency of all values above the predetermined threshold in the frequent value table that satisfy the query from

the total number of rows in the database table. In fact, Burger expressly teaches away from the examiner's conclusion. Burger deals with a sample, which is defined in the Burger Abstract to mean "less than all rows of the table." The limitations in claim 2 recite:

> . . . the formula accounting for data skew in the database table by subtracting the frequency of all values above the predetermined threshold in the frequent values list that satisfy the query from the total number of rows in the database table.

Because Burger by its express terms deals with less than all rows of the table, Burger expressly teaches away from subtracting the frequency of all values above the predetermined threshold in the frequent values list that satisfy the query from the *total number of rows in the database table*. Burger does not deal with the total number of rows in the database table because Burger only deals with a sample, which is less than the total number of rows in the database table. This shows conclusively that Burger expressly teaches away from the examiner's proposed combination of Burger and AAPA.

In the examiner's stated motivation for combining Burger and AAPA to allegedly arrive at the teachings in claim 2, the examiner states: "Thus, given the existing prior art probabilistic formula for estimating cardinality, one of ordinary skill in the art would be apprised to modify it to account for data skew." This statement is conclusory, and can only be made using hindsight reconstruction. Burger modifies the sample size when data skew is detected. Modifying sample size has no relation whatsoever to the calculation of a cardinality estimate. One of ordinary skill in the art would be motivated to modify sample size to account for data skew as taught by Burger, but would not be motivated to modify how cardinality is estimated in the AAPA to account for data skew as taught by Burger.

Nowhere does Burger teach the subtracting function expressly recited in claim 2. Nowhere does AAPA teach the subtracting function expressly recited in claim 2.

Because neither Burger nor AAPA teach this limitation, the examiner has failed to establish a prima facie case of obviousness for claim 2 under 35 U.S.C. §103(a). Neither Burger nor AAPA teach or suggest the subtracting function recited in claim 2. As a result, claim 2 is allowable over the combination of Burger and AAPA. In addition, claim 2 depends on claim 1, which is allowable for the reasons given above. As a result, claim 2 is also allowable as depending on an allowable independent claim. Applicants respectfully request reconsideration of the examiner's rejection of claim 2 under 35 U.S.C. §103(a).

Claim 3

In rejecting claim 3, the examiner admits that Burger does not expressly disclose the claimed formula, and inherently admits by reciting the disclosed formula for AAPA that AAPA does not expressly disclose the claimed formula. The examiner then states:

> At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Burger by using the formula taught by AAPA, however modified by Burger's teachings to account for data skew.

This motivation to combine is lacking, because it does not state that how or why one of ordinary skill in the art would arrive at the specific formula in claim 3. As a result, the examiner has failed to establish a prima facie case of obviousness for claim 3 under 35 U.S.C. §103(a). Neither Burger nor AAPA teach or suggest the specific formula in claim 3. As a result, claim 3 is allowable over the combination of Burger and AAPA. In addition, claim 3 depends on claim 2, which depends on claim 1, which is allowable for the reasons given above. As a result, claim 3 is also allowable as depending on an allowable independent claim. Applicants respectfully request reconsideration of the examiner's rejection of claim 3 under 35 U.S.C. §103(a).

Claim 4

The examiner rejected claim 4 based on the rejection of claims 1-3. The rejection of claims 1-3 is in error for the many reasons discussed above. As a result, claim 4 is allowable for the same reasons given above for the allowability of claims 1-3. Applicants respectfully request reconsideration of the examiner's rejection of claim 4 under 35 U.S.C. §103(a).

Claims 5-8

The examiner rejected claims 5-8 based on the rejection of claims 1-4. The rejection of claims 1-4 is in error for the many reasons discussed above. As a result, claims 5-8 are allowable for the same reasons given above for the allowability of claims 1-4. Applicants respectfully request reconsideration of the examiner's rejection of claim 5-8 under 35 U.S.C. §103(a).

Claim 9

The examiner rejected claim 9 based on the rejection of claim 1. The rejection of claim 1 is in error for the many reasons discussed above. As a result, claim 9 is allowable for the same reasons given above for the allowability of claim 1. Applicants respectfully request reconsideration of the examiner's rejection of claim 9 under 35 U.S.C. §103(a).

Claims 10-11 and 15-16

Claims 10-11 and 15-16 have been cancelled herein, and therefore need not be addressed.

Claims 12-14

The examiner rejected claims 12-14 based on the rejection of claims 2-4. The rejection of claims 2-4 is in error for the many reasons discussed above. As a result, claims 12-14 are allowable for the same reasons given above for the allowability of claims 2-4. Applicants respectfully request reconsideration of the examiner's rejection of claim 12-14 under 35 U.S.C. §103(a).

General Comments

All of the examiner's rejections under 35 U.S.C. §103(a) are based on the same faulty combination of Burger and AAPA. The teachings of these two are distinct, and there is no teaching or suggestion in either of these references or in general knowledge in the art that accounting for data skew in Burger can or should affect the estimated cardinality taught in AAPA. Accounting for data skew in Burger is done so the sample size in Burger can be increased, which has nothing whatsoever to do with estimating cardinality. Because the examiner's combination of Burger and AAPA is improper under 35 U.S.C. §103(a), all of the pending claims are allowable over the combination of Burger and AAPA.

Conclusion

In summary, none of the cited prior art, either alone or in combination, teach, support, or suggest the unique combination of features in applicants' claims presently on file. Therefore, applicants respectfully assert that all of applicants' claims are allowable. Such allowance at an early date is respectfully requested. The Examiner is invited to telephone the undersigned if this would in any way advance the prosecution of this case.

Respectfully submitted,

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